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**IN THE APPLICATION OF**  
**MICHAEL J. MALONE**  
**FOR A**  
**SERIAL HARD DISK DRIVE SELECTOR**

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates generally to a Serial Hard Disk Drive Selector mechanism that permits the easy and rapid replacement of one serial hard disk drive that occupies a unique, logical position in a computer system with another serial hard disk drive. The replacement occurs while the computer system is off. The replacement occurs without the removal of either serial hard disk drive.

### 2. Description of the Related Art

All components of a personal computer system are connected to each other and communicate with each other over a series of electrical conductors. Over other electrical conductors, electrical power is delivered to the components of the computer system. These conductors are typically wires or they are wire traces that are part of the electrical circuit boards that are used to construct computers. Together, these conductors are termed the computer system's bus. The complete computer system has a many-branched bus. The most peripheral segments are referred to as peripheral buses. In this application I will refer to these connections generically as either a trace or as traces.

The modern computer system has an architecture that relieves the central processing unit of much of the work of directly controlling the other components of the system. This is accomplished by placing host adapters within the bus of the computer system between the central processing unit and other computer system devices. These host adapters recognize instructions directed at their attached devices and cause their attached devices to perform as directed. Today's computer

01 components are typically smart devices; they can often relieve the central processing  
02 unit of tasks by directly communicating with and accomplishing tasks with other  
03 computer components without utilizing the central processing unit directly. The  
04 various host adapters mediate these functions.  
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09 The host adapters of interest to this inventor are those that control hard disk  
10 drives. The bus segments of interest to this inventor are those connecting these host  
11 adapters to the computer system, those connecting the hard disk drives to the host  
12 adapter, and those delivering power to the hard disk drives. The peripheral devices  
13 of interest to this inventor are those hard disk drives, which are permanently  
14 mounted within a personal computer system.  
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21 Attached Figures 1 to and including 11 depict various relationships for these three  
22 component parts of a computer. Depictions are included for ATA (Advanced  
23 Technology Attachment) circuitry; for SCSI ( Small Computer System) circuitry; for  
24 USB (Uniform Serial Bus) circuitry; for IEEE 1394 (Institute of Electrical and  
25 Electronics Engineers) circuitry; and, for S-ATA (Serial Advanced Technology  
26 Attachment ) circuitry. ATA, SCSI, USB, IEEE 1394, and S-ATA are  
27 communication protocols. Attached Figures 4 to and including 11 depict these three  
28 component parts relationships when the Serial Hard Disk Drive Selector is part of the  
29 system.  
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39 Host adapters are labeled as 300, and each Figure has an additional entitling for  
40 its host adapter that identifies it as either an ATA, SCSI, USB, IEEE 1394, or S-ATA  
41 host adapter.  
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44

45 Hard disk drives, in like manner, are labeled 400 with an additional entitling that  
page 6

01 identifies it as an ATA, SCSI, etc., hard disk drive, etc. Hard disk drive is  
02  
03 abbreviated to HDD.

04       The bus of a typical personal computer system has six component parts. The first  
05  
06 part is the traces that deliver power to components attached to the bus. This  
07  
08 component is labeled 200A in all figures and entitled power delivery traces of bus  
09  
10 system. The second part is the traces that deliver command signals. This component  
11  
12 is labeled 200B in all figures and entitled command delivery traces of bus system.  
13  
14 The third part is the traces that carry address signals. This is labeled 200C in all  
15  
16 figures and entitled address delivery traces of the bus system. The fourth is the  
17  
18 traces that deliver data. This is labeled 200D in all figures and is entitled data  
19  
20 delivery traces of the bus system. The fifth part is the traces that delivery timing  
21  
22 signals. This is labeled 200E in all figures and entitled timing delivery traces of the  
23  
24 bus system. When traces 200B, C and D are combined, the Figures show this as  
25  
26 200F. The sixth part is the traces or wires that deliver power directly to the  
27  
28 computer's components. These traces come directly from the computer system's  
29  
30 power supply to a component. This part is labeled 100 in all figures and is entitled  
31  
32 dc power.  
33

34       The bulk of communications passed over the bus of a personal computer system  
35  
36 is sent as parallel signals or as coordinated signals sent down many differing traces  
37  
38 simultaneously; many being eight, or sixteen; or thirty two, or sixty four. Advances  
39  
40 in electronics have recently led to the developed of much higher speed  
41  
42 communication techniques using serial signals. Serial signals are coordinated signals  
43  
44 sent down few traces; few being one or two. Part of this high-speed communication  
45

01 development is the introduction of serial hard disk drives for use in personal  
02 computer systems. These newly developed serial hard disk drives promise to  
03 replace, the now commonly used, parallel hard disk drives.  
04

05  
06 The commonly used parallel hard disk drives are the ATA and SCSI hard disk  
07 drives. At this time, three serial hard disk drives are readily available. They are the  
08 Serial ATA or S-ATA, IEEE 1394, and USB hard disk drives. IEEE 1394 and USB  
09 hard disk drives are typically external peripheral devices but internal computer  
10 component versions exist. Serial ATA or S-ATA is typically an internal peripheral  
11 component.  
12

13  
14 Figure 1 depicts two different relationships; that of the ATA and SCSI devices.  
15 They are different devices, but their simplified schematics are the same. This figure  
16 shows that the bus components 200A, B, C, D, and E communicate with the ATA or  
17 SCSI parallel host adapter, 300, but that only components 200B, C, and D  
18 communicate with the ATA or SCSI parallel hard disk drive, 400. The parallel hard  
19 disk drives receive their power directly from the computer's power supply system  
20 via component 100, the dc power source.  
21

22  
23 Figures 2 depicts two different relationships; that of the USB and the IEEE 1304  
24 devices. IEEE is Institute of Electrical and Electronics Engineers; USB is Uniform  
25 Serial Bus. They are different devices but their simplified schematics are the same.  
26 This figure shows that the bus components 200A, B, C, D, and E communicate with  
27 the USB or IEEE 1394 serial host adapter, 300, but that bus components 200B, C,  
28 and D are combined and connect to either the USB or IEEE1394 serial hard disk  
29 drive, 400, via bus component 200F. Power to these serial hard disk drives is from  
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01 bus component 200A. Bus component 100, dc power supply, does not, typically,  
02  
03 connect to the USB or IEEE 1394 serial hard disk drive.  
04

05 Figure 3 depicts the typical relationship between an S-ATA host adapter, 300, and  
06  
07 its serial hard disk drive, 400. This figure shows that bus components 200A, B, C,  
08  
09 D, and E communicate with the S-ATA host adapter but that components 200B, C  
10  
11 and D are combined and communicate with the hard disk drive, 400, via a single  
12  
13 component, 200F. Power is supplied to the S-ATA hard disk drive by bus  
14  
15 component 100, directly from the system's power supply.  
16

17 The most distinguishing architectural feature of the serial hard disk drives is the  
18  
19 use of a peripheral bus component that serves multiple functions; specifically, the  
20  
21 command, address, and data delivery. Component 200F is unique to the serial bus  
22  
23 architecture. Command, address, and data delivery for the parallel hard disk drive  
24  
25 bus is accomplished by separate components.  
26

27 In patent No. US 6,480,350 B1, dated November 12, 2002, inventor Malone  
28  
29 discloses the present state of the art with his patented hard disk drive selector.  
30  
31 Malone's invention is a three component, multi-pole, multi-throw, switching device  
32  
33 that resides permanently within a personal computer system. The hard disk drive  
34  
35 selector permits the rapid and easy replacement of one permanently mounted  
36  
37 physical parallel hard disk drive occupying a single logical position within a  
38  
39 computer system with another permanently mounted parallel hard disk drive within  
40  
41 the same computer system. Malone's Hard Disk Drive Selector is configurable and  
42  
43 can be used to choose any one parallel hard disk drive for use from a plurality of  
44  
45 available parallel hard disk drives permanently mounted within the computer system.

01       When Malone's invention is used, a particular setting is chosen while the computer  
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03       system is off. When the computer system is turned on, booted, the selected parallel  
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05       hard disk drive is used for that entire computer use session. If another parallel hard  
06  
07       disk is to be used, the computer system is turned off. When the computer system is  
08  
09       turned off, the other parallel hard disk drive is selected utilizing Malone's Hard Disk  
10  
11       Drive Selector and the computer is booted with the newly selected parallel hard disk  
12  
13       drive in use for this new computer use session.

14  
15       Malone's invention, the Hard Disk Drive Selector resides between the parallel  
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17       hard disk drive host adapter and its parallel hard disk drive and within the hard disk  
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19       drive's peripheral bus system. The Hard Disk Drive Selector also resides between  
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21       the system's power supply and parallel hard disk drive.

22  
23       Malone's invention specifically aims at controlling the bus of a peripheral hard  
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25       disk drive that has four distinct segments. The four segments are the power delivery  
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27       bus components, the command delivery bus components, the address delivery bus  
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29       components, and the data delivery bus components. When operated, Malone's  
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31       invention opens the power, command, and address delivery components to any and  
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33       all not-selected hard disk drives controlled by the invention and closes the power,  
34  
35       command, and address components to the selected hard disk drive controlled by the  
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37       invention. With this invention, the data delivery components of the peripheral hard  
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39       disk drive bus are left closed to all hard disk drives controlled by the invention at all  
40  
41       times; to both selected and not-selected hard disk drives controlled by the invention.

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43       Malone's invention is specific to the control of and selection and not-selection of  
44  
45       parallel type hard disk drives.

01 Malone's invention, The Hard Disk Drive Selector, offers unprecedented  
02  
03 versatility and protection in the use and storage of parallel hard disk drives and in the  
04  
05 protection of software and data stored on the drives, but it fails to work with serial  
06  
07 hard disk drives and to extend this protection to serial hard disk drives.

08  
09 Already developed devices are now discussed.

10  
11 U.S. Pat. No. 6,480,350 B1, issued to Malone, discloses a device that permits the  
12  
13 user selected use of one parallel hard disk drive from a plurality of parallel hard disk  
14  
15 drives controlled by his invention.

16  
17 U.S. Pat. No. 6,009,518 A, issued to Shiakallis, discloses a device and means of  
18  
19 separating and storing data in differing locations during a single computer use  
20  
21 session.

22  
23 U.S. Pat No. 6,272,533 B1, issued to Browne, discloses a device and means to  
24  
25 prevent the writing of data to a hard disk drive while permitting reading of data from  
26  
27 the hard disk drive.

28  
29 U.S. Pat. No. 3,986,169, issued to Kobayashi et al., discloses a device that permits  
30  
31 the transferring of data between two computer systems.

32  
33 U.S. Pat No. 4,176,341, issued to Miyazaki, discloses a device that permits time-  
34  
35 sharing of a data path by multiple Input/Output devices.

36  
37 U.S. Pat. No. 5,574,929, issued to Pieterse et al., discloses a device that permits a  
38  
39 computer system to use two central processing units.

40  
41 U.S. Pat. No. 5,630,171, issued to Chejlava, Jr., et al., discloses a device that  
42  
43 translates Direct Memory Access mode data transfers into Input/Output mode data  
44  
45 and other data modes.



01 U.S. Pat No. 5,761,460, issued to Santos et al., discloses a temporary dual-master  
02  
03 storage device.

04  
05 U.S. Pat. No. 5,724,554, issued to Gish, discloses a device and method that  
06  
07 permits a 25 pin computer connecting cable to automatically switch from serial to  
08  
09 parallel mode or to automatically switch from parallel to serial mode.

10  
11 International Pat. No 83305547.8, issued to Barber, discloses a device that allows  
12  
13 dual port access to a target circuit after determining priority of need for use of the  
14  
15 circuit determined by algorithm.

16  
17 Malone discloses a device that controls parallel hard disk drives only. The other  
18  
19 inventors sited all disclose inventions that are active mediators within the data path  
20  
21 whether the data path is serial or parallel.

22  
23 These references are cited after search of International Patent Classes G 06 F  
24  
25 13/00 and G 11 B 05/02 and U. S. Patent Classes 360/61, 63, 64, 69, 137 and  
26  
27 711/112.

## SUMMARY OF THE PRESENT INVENTION

This application for patent of an invention discloses a novel method and technique that permits the rapid and easy replacement of one, permanently mounted, serial hard disk drive by another permanently mounted, serial hard disk drive in a single, logical serial hard disk drive position in a personal computer system. The method and invention allows the exchange to be made without the physical removal and replacement of the serial hard disk drives and is accomplished by multi-pole, multi-throw switching devices. This method, additionally, provides software security that otherwise, could only be accomplished by the removal of the serial hard disk drive from the computer system.

## BRIEF DESCRIPTIONS OF THE DRAWINGS

There are fourteen drawings and charts. All are titled as Figure. All of the Figures are in related sets. For simplicity, each figure depicting the operation of this device will only show two devices attached to the invention. The invention is able to control two, three, four, etc., number of devices.

The first set is comprised of Figures 1, 2, and 3. Figures depict the typical relationship between parallel and serial hard disk drives.

Figure 1 is specific to the ATA and SCSI environment. It shows the typical relationship between the computer system's bus and the computer system's host adapter; the host adapter and the hard disk drive; and the hard disk drive and the system's power supply.

Figure 2 is specific to the USB or IEEE 1394 environment. It shows the typical relationship between the computer system's bus and the computer system's host adapter; the host adapter and the hard disk drive; and the hard disk drive and the system's power supply.

Figure 3 is specific to the S-ATA environment. It shows the typical relationship between the computer system's bus and the computer system's host adapter; the host adapter and the hard disk drive; and the hard disk drive and the system's power supply.

The second set is comprised of Figures 4 and 5. Figures 4 and 5 depict the Serial Hard Disk Drive Selector as it is to be placed between the serial host adapter and the serial hard disks this invention controls the choice of. These figures are specific to the USB serial formats.

01        Figure 4: Shows the Serial Hard Disk Drive Selector selecting the serial hard disk  
02  
03 drive at depict the Serial Hard Disk Drive Selector 1 position and not-selecting the  
04  
05 serial hard disk drive at depict the Serial Hard Disk Drive Selector 2 position.  
06

07        Figure 5: Shows depict the Serial Hard Disk Drive Selector selecting the serial  
08  
09 hard disk drive at depict the Serial Hard Disk Drive Selector 2 position and not-  
10  
11 selecting the serial hard disk drive at depict the Serial Hard Disk Drive Selector 1  
12  
13 position.  
14

15        The third set is comprised of Figures 5 and 6. Figures 6 and 7 depict the Serial  
16  
17 Hard Disk Drive Selector as it is to be placed between the serial host adapter and the  
18  
19 serial hard disks the Serial Hard Disk Drive Selector controls the choice of. These  
20  
21 figures are specific to the IEEE1394 serial formats.  
22

23        Figure 6: Shows the Serial Hard Disk Drive Selector selecting the serial hard disk  
24  
25 drive at the Serial Hard Disk Drive Selector 1 position and not-selecting the serial  
26  
27 hard disk drive at the Serial Hard Disk Drive Selector 2 position.  
28

29        Figure 7: Shows the Serial Hard Disk Drive Selector selecting the serial hard disk  
30  
31 drive at the Serial Hard Disk Drive Selector 2 position and not-selecting the serial  
32  
33 hard disk drive at the Serial Hard Disk Drive Selector 1 position.  
34

35        The fourth set is comprised of Figures 8 and 9. Figures 8 and 9 depict the Serial  
36  
37 Hard Disk Drive Selector as it is to be placed between the serial host adapter and the  
38  
39 serial hard disks the Serial Hard Disk Drive Selector controls the choice of. These  
40  
41 figures are specific to the Serial ATA format.  
42

43        Figure 8: Shows the Serial Hard Disk Drive Selector selecting the serial hard disk  
44  
45 drive at the Serial Hard Disk Drive Selector 1 position and not-selecting the serial

01 hard disk drive at the Serial Hard Disk Drive Selector 2 position.

02  
03 Figure 9: Shows the Serial Hard Disk Drive Selector selecting the serial hard disk  
04  
05 drive at the Serial Hard Disk Drive Selector 2 position and not-selecting the serial  
06  
07 hard disk drive at the Serial Hard Disk Drive Selector 1 position.

08  
09 The fifth set is comprised of Figures 10 and 11. Figures 10 and 11 depict the  
10  
11 component parts of the Serial Hard Disk Drive Selector and the relationship these  
12  
13 component parts have to the host adapter and the general computer system bus.

14  
15 Figure 10: Shows the component parts of the Serial Hard Disk Drive Selector  
16  
17 selecting the serial hard disk drive at the Serial Hard Disk Drive Selector 1 position  
18  
19 and not-selecting the serial hard disk drive at the Serial Hard Disk Drive Selector 2  
20  
21 position.

22  
23 Figure 11: Shows the component parts of the Serial Hard Disk Drive Selector  
24  
25 selecting the serial hard disk drive at the Serial Hard Disk Drive Selector 2 position  
26  
27 and not-selecting the serial hard disk drive at the Serial Hard Disk Drive Selector 1  
28  
29 position.

30  
31 The sixth set is composed of Figures 12, 13, and 14. Each of these figures is a  
32  
33 table depicting the various connection pinnouts that are to be considered in  
34  
35 configuring this invention.

36  
37 Figure 12: Shows the Uniform Serial Bus hard disk drive pinnout.

38  
39 Figure 13: Shows the IEEE 1394 hard disk drive pinnout.

40  
41 Figure 14: Shows the Serial ATA hard disk drive pinnout.  
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01 **DETAILED DESCRIPTION OF THE PREFERRED**  
02 **EMBODIMENT OF THE INVENTION**  
03

04  
05 This Serial Hard Disk Drive Selector is a device that controls the selection of  
06  
07 one physical, permanently mounted, serial hard disk drive to occupy a single logical  
08  
09 hard disk drive position in a personal computer system. The choice is made from  
10  
11 two, three, four, etc., physical, permanently mounted, serial hard disk drives  
12  
13 attached to the invention.  
14

15 The Serial Hard Disk Drive Selector had three component parts. These parts are  
16  
17 depicted in Figures 10 and 11 and are labeled as 501, 502, and 503. In all other  
18  
19 Figures in which the Serial hard Disk Drive Selector is depicted, the three  
20  
21 component parts are depicted as a single element and labeled as 500.  
22

23 The first component part, 501, is the power control delivery component. It is a  
24  
25 multi-pole, multi-throw switching device that controls the power traces for power  
26  
27 delivered directly from the computer system's power supply via dc power supply;  
28  
29 100, and/or the computer system's power delivery traces of bus, 200A, to all serial  
30  
31 hard disk drives permanently mounted in the computer system, attached to the Serial  
32  
33 Hard Disk Drive Selector, 500, and selected for use by the Serial Hard Disk Drive  
34  
35 Selector, 500. The power control delivery component closes all power delivery  
36  
37 traces to a selected serial hard disk drive and opens all power delivery traces to all  
38  
39 not-selected serial hard disk drives. The power delivery component, 501, is  
40  
41 configurable. Being configurable means that it resides either in the dc power supply,  
42  
43 100, between the computer system power supply and the serial hard disk drive, 400,  
44  
45 or between the serial host adapter, 300, and the serial hard disk drive, 400, within the  
page 17

01 power delivery traces of the bus, 200A, or both. Being configurable also means that  
02  
03 the number of poles needed to effect this component differ from one serial format to  
04  
05 another; these differing pole requirements are described in Figures 11, 12, and 13.  
06

07 Component 501 would require two (2) poles in the USB environment; two (2) poles  
08  
09 in the IEEE 1394 environment; and, fifteen (15) poles in the S-ATA environment.  
10

11 Being configurable also means that this component may be constructed of  
12  
13 mechanical, electromechanical, and/or electronic sub-components.  
14

15 The second component part, 502, is the command, address, and data control  
16  
17 delivery component. It is a multi-pole, multi-throw switching device that controls  
18  
19 the combined command and address and data delivery traces, 200F, between all  
20  
21 serial hard disk drives, 400, permanently mounted in the computer system and the  
22  
23 serial host adapter, 300, that are connected to the Serial Hard Disk Drive Selector,  
24  
25 500. The command, address, and data control delivery component closes all  
26  
27 combined command, address, and data delivery traces, 200F, to the selected serial  
28  
29 hard disk drive and opens all combined command, address and delivery traces, 200F,  
30  
31 to all not-selected serial hard disk drives. The command, address, data control  
32  
33 delivery component, 502, is configurable. Being configurable also means that the  
34  
35 number of poles needed to effect this component differ from one serial format to  
36  
37 another; these differing pole requirements are described in Figures 11, 12, and 13.  
38

39 Component 502 would require three (3) poles in the USB environment; five (5) poles  
40  
41 in the IEEE 1394 environment; and, seven (7) poles in the S-ATA environment.  
42

43 Being configurable also means that this component may be constructed of  
44  
45 mechanical, electromechanical, and/or electronic sub-components.

01 The third component part, 503, is the master control component. The master  
02  
03 control component is a multi-pole, multi-throw switch that controls the function of  
04  
05 components 501 and 502; the computer operator can readily accesses this component  
06  
07 from outside the computer system's case. The master control component is  
08  
09 configurable. Being configurable means that an appropriate number of poles would  
10  
11 be used to synchronously control 501 and 502. Being configurable also means that  
12  
13 this component may be constructed of mechanical, electromechanical, and/or  
14  
15 electronic sub-components.

16  
17 These three components, 501, 502, and 503 function only as a single unit; they  
18  
19 operate synchronously.  
20

21 The Serial Hard Disk Drive Selector, 500, is depicted in various serial protocol  
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23 environments in figures 4, 5, 6, 7, 8, and 9. In Figures 4 and 5, it is depicted in the  
24  
25 Uniform Serial Bus environment. In Figures 6 and 7, it is depicted in the IEEE1394  
26  
27 environment. In Figures 8 and 9, it is depicted in the Serial ATA environment. In  
28  
29 figures 4, 6, and 8, the Serial Hard Disk Drive Selector is shown selecting the left  
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31 hand serial hard disk drive and not-selecting the right hand serial hard disk drive. In  
32  
33 Figures 5, 7, and 9, the Serial Hard Disk Drive Selector is shown selecting the right  
34  
35 hand serial hard disk drives and not-selecting the left hand serial hard disk drives.  
36  
37 These figures, 4 to and including 9, depict only two serial hard disk drives for  
38  
39 graphic simplicity; the Serial Hard Disk Drive can be configured for one, two, three,  
40  
41 four, etc., number of serial hard disk drives.  
42

43 Any hard disk drive whose position in a computer system is controlled by the  
44  
45 Serial Hard Disk Drive Selector and that is a not-selected serial hard disk drive



01 during any operating session has its contents completely protected from both reading  
02  
03 and writing operations.  
04

05 The master control components function is controlled by a keyed switch that uses  
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07 a removable key.  
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